Rock Chips
Winter 2006

Surficial Geology Mapping Web Page Launched

In 2000, the Alberta Geological Survey (AGS) initiated a long-term, regional surficial mapping program of northern Alberta. This program benefits several stakeholders, including the mineral exploration, energy and forestry industries, by providing baseline geological information for northern Alberta. Surficial geology maps contain information on the surface sediments (the ground we live upon) and provide insights to surface material properties, morphology and genesis. The maps accommodate the increasing demand for geological information for infrastructure development and land-use planning (e.g., granular aggregate, landslide potential, permafrost) in northern Alberta.

The objective of the surficial mapping program is to complete the surficial geology mapping of northern Alberta along with complementary studies, such as ice-flow mapping, Quaternary stratigraphy and sedimentology. Ultimately, this new information will be merged with existing maps from southern and central Alberta to create a uniform surficial geology map for the entire province. The AGS is responding to increasing queries from various clients (e.g., industry, academia and government agencies) regarding existing surficial geology map and GIS data coverage within Alberta. Large portions of northern Alberta still remain unmapped, but since 2000, significant progress has been made with the mapping of seven 1:250 000 NTS areas.

Recently, a surficial mapping web page was added to the AGS website at

http://www.ags.gov.ab.ca/activities/surficial_mapping/surficial_mapping.html.

Screen capture of the surficial mapping web page showing surficial mapping coverage for Alberta. By clicking any of the NTS tiles, you can download surficial maps and reports for that area.

Alberta Geological Survey

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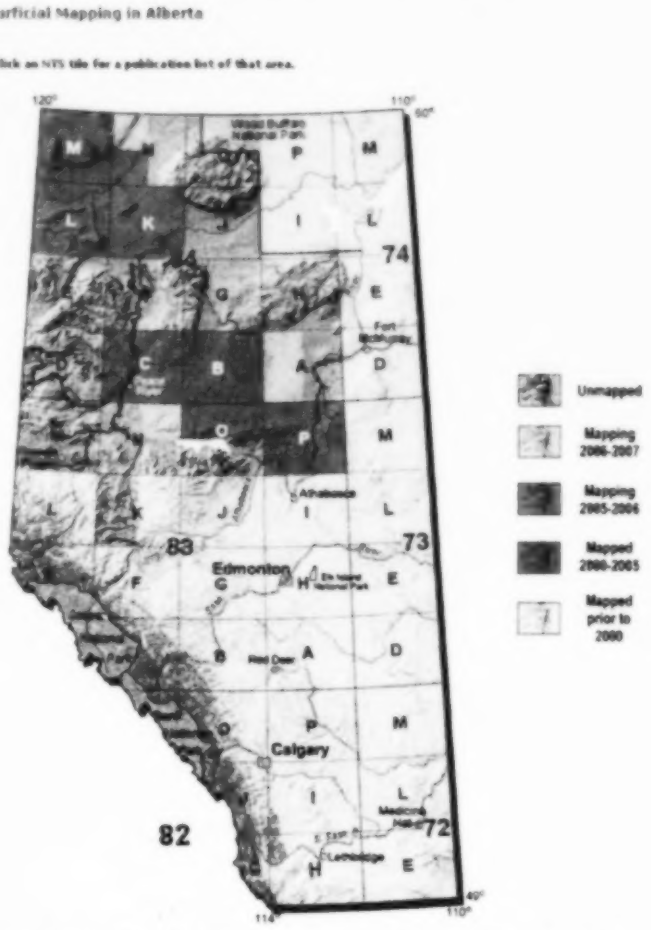
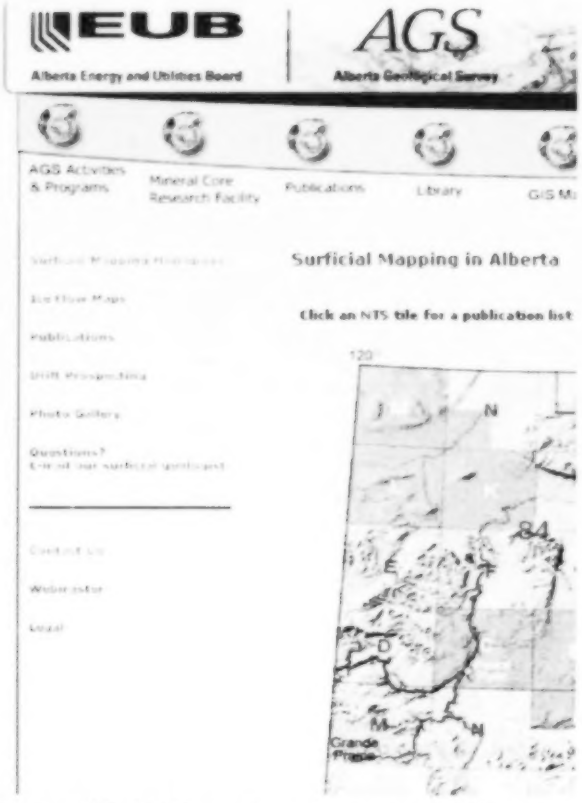


Screen capture of the surficial mapping web page showing surficial mapping coverage for Alberta. By clicking any of the NTS tiles, you can download surficial maps and reports for that area.

EUB Alberta Energy and Utilities Board
AGS

You are greeted with a map showing generalized surficial mapping coverage for Alberta. Behind this image is a dynamic search engine designed to query a database for surficial geology maps, surface materials maps, aggregate maps and other related data. Simply click an NTS tile to see what surficial geology information is available for that area. Since queries are linked to an active database, the web page will update as new maps and publications are released.

On the left side of web page are links to surficial geology and drift prospecting publications. These include reports, external papers, presentations and Rock Chips articles pertaining to the AGS surficial mapping program. There is also a photo gallery from recent surficial mapping activities highlighting some of northern Alberta's glacial landforms and glacial stratigraphy. The Ice Flow Maps page provides regional ice flow information for northern Alberta, as well as an animated gif, draped over a provincial digital elevation model, showing the approximate recession of the Laurentide Ice Sheet through a series of time slices from 16 000 to 8 500 years before present.



Close-up of Surficial Mapping home page, showing the left side with related links to other resources.

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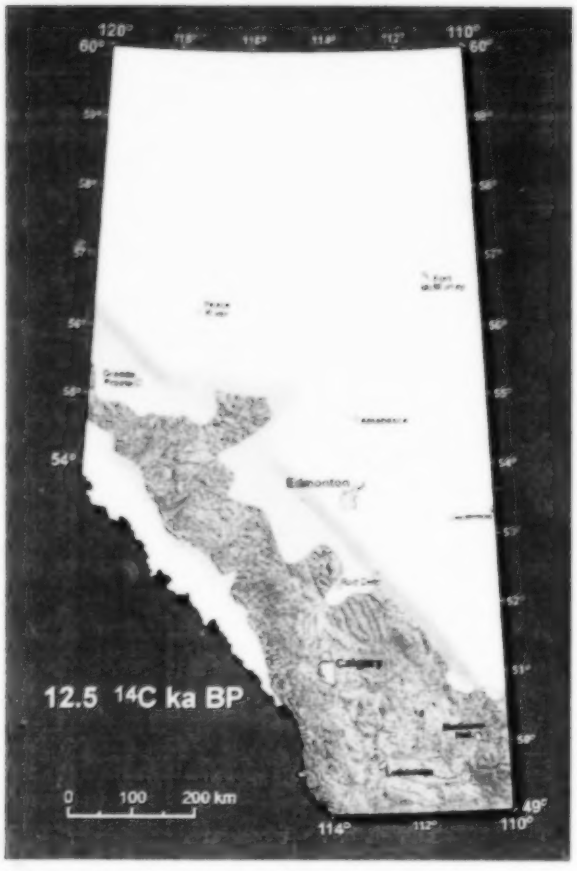

Screen capture of the animation showing the retreat of the Laurentide Ice Sheet in Alberta. Source: Dyke, A.S., Moore, A. and Robertson, L. (2003): Deglaciation of North America: Geological Survey of Canada, Open File 1574.

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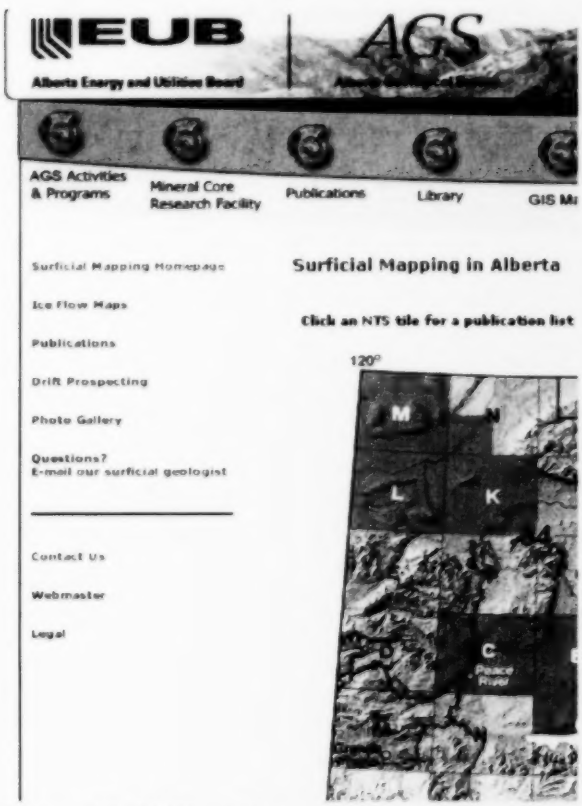

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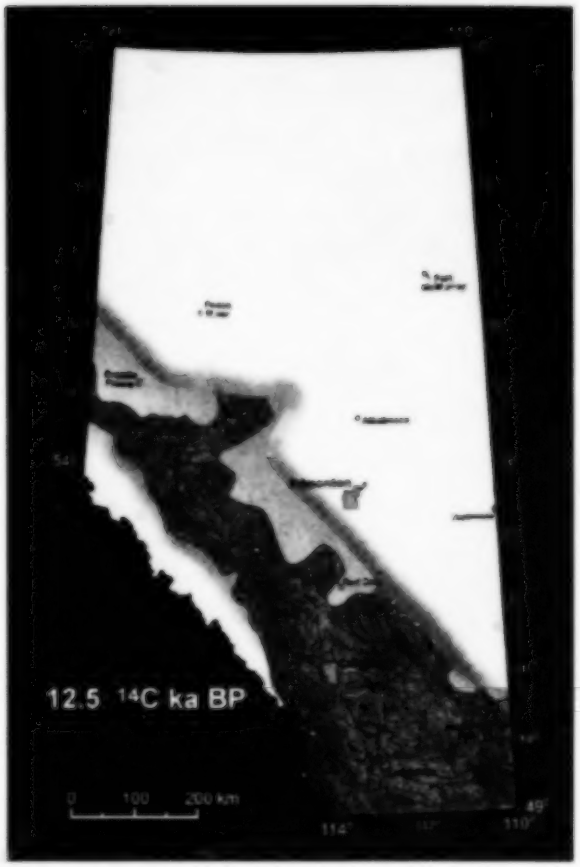

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Check Out Our Library	Linda White	(780) 422-1685
AGS Staff Lead Geology Field Trip on Sour Gas Production and Acid Gas Injection	Maja Buschkuehle	(780) 422-2728

Staff may also be contacted via e-mail by entering the author's first name.last name@eub.ca

Comments and suggestions for Rock Chips may be sent to Maryanne Protz at maryanne.protz@eub.ca

AGS Staff Lead Geology Field Trip on Sour Gas Production and Acid Gas Injection

Over the past 15 years, oil and gas producers in Alberta and British Columbia have been faced with a growing challenge to reduce atmospheric emissions of hydrogen sulphide (H_2S), which is produced from "sour" hydrocarbon pools. Sour oil and gas are hydrocarbons that contain H_2S and CO_2, which have to be removed before the produced oil or sweet gas is sent to market. Because desulphurization is uneconomic and surface storage of the produced elemental sulphur constitutes a liability, increasingly more operators are disposing the mixture of H_2S and CO_2, also called acid gas, into deep geological formations. Although the main purpose of acid-gas injection operations is to dispose of H_2S, significant quantities of CO_2 are being injected at the same time. With the current effort to reduce CO_2 emissions, these operations are small-scale analogues to future large-scale geological storage of CO_2 (a greenhouse gas).

For the past 5 years, AGS, as part of a consortium of federal and provincial government agencies and industry partners, conducted a number of projects characterizing the subsurface geology and hydrogeology of these operations. A list of these projects can be viewed at **http://www.ags.gov.ab.ca/activities/co2/projects.shtml**

During September 18-20, 2006, the Alberta Geological Survey conducted a field trip entitled "**Source to Sink - Sour Gas Production and Acid Gas Injection in the Rocky Mountain Foothills and Alberta Plains.**" Drs. Maja Buschkuehle and Shahin Dashtgard led the field trip for representatives of the consortium.

The field trip provided an overview of the production of sour gas and the technology used to dispose of the resultant acid gas. It then focused on the geology of injection horizons by visiting outcrops of siliciclastics and carbonates in the Rocky Mountain Foothills and Front Ranges, whose subsurface equivalents are used for acid-gas injection and/or CO_2-enhanced oil recovery (EOR) elsewhere in the province.

The group left Edmonton and travelled to the Hansmann Lake gas plant near Provost, to observe and discuss sour-gas processing and acid-gas injection technologies. Participants saw the acid-gas injection well, associated gas plant operations and factors involved in delivering sweet gas downstream. The field trip leaders presented an overview of the geology and hydrogeology of the five acid-gas injection sites in the Provost area (Figures 1 and 2), four of which are currently active.

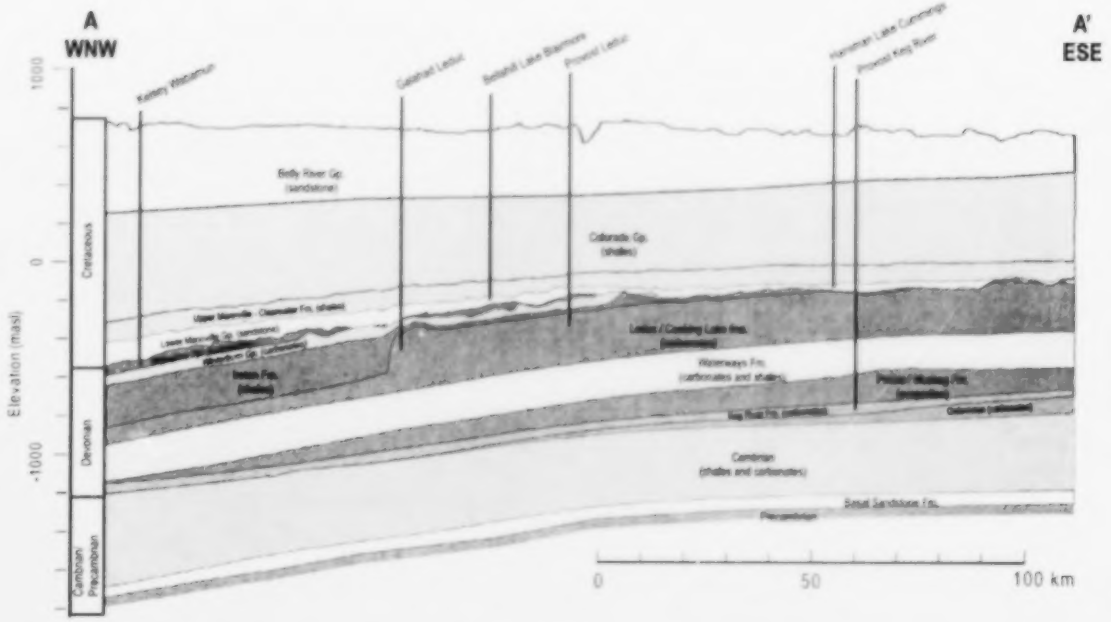

Figure 1. Stratigraphic cross-section through the Provost area showing the relative position of the various target horizons in the Devonian to Cretaceous succession for acid-gas injection. The location of the cross-section is shown in Figure 2.

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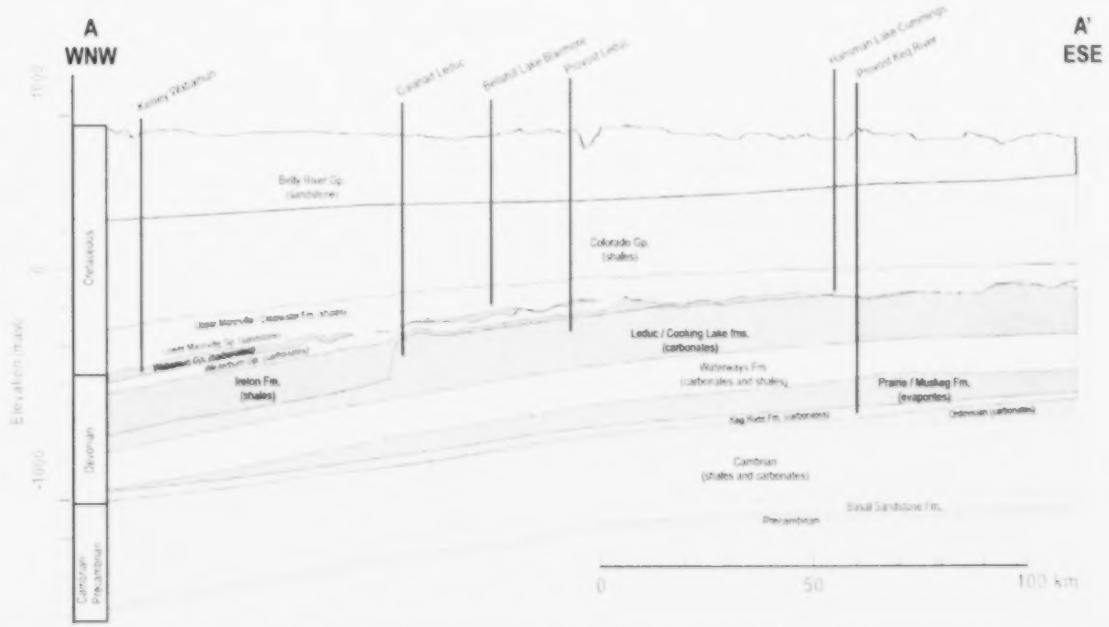

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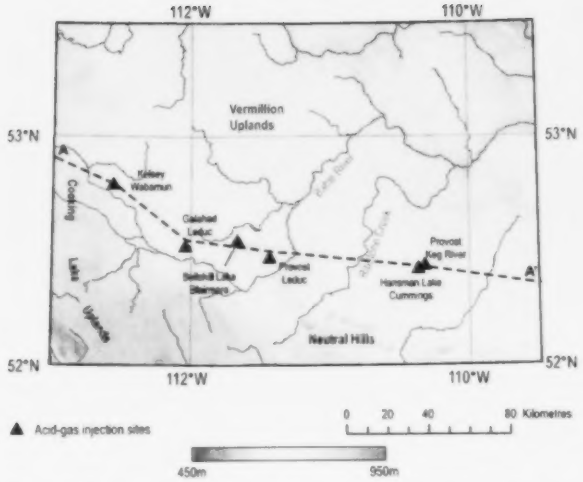

Figure 2. Topographic map of the Provost area showing the location of the acid-gas injection sites.

The field trip continued on to Big Hill Springs Provincial Park, northwest of Calgary, where groundwater, charged with calcium carbonate from the dissolution of carbonate cement in the Paskapoo sandstone, discharges and is re-precipitated as a type of limestone called tufa (Figure 3). This stop illustrated the nature and controls of fluid-rock interactions that occur when acid gases (CO_2 and/or H_2S) are injected into subsurface rock formations.

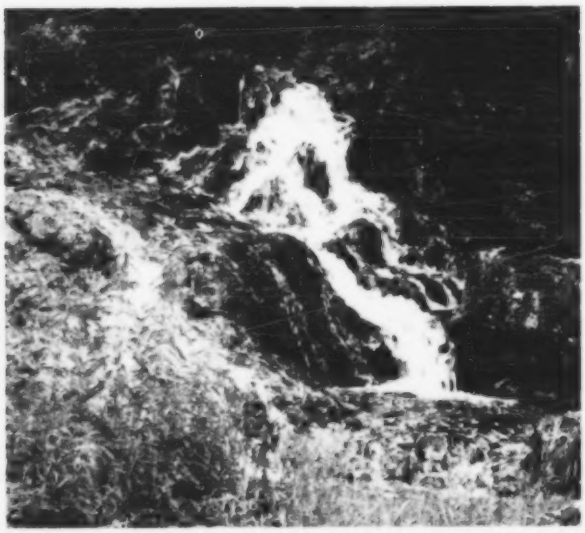

Figure 3. Bighill Creek cascades over tufa mounds.

The next stop was downstream of the Seebe Dam to examine exposures of the Cardium Formation (Figures 4 and 5) - a major oil and gas producing zone presently being evaluated for large scale CO_2-storage and enhanced oil recovery in the giant Pembina oil field southwest of Edmonton. Field trip participants were introduced to the geology, sedimentology and ichnology (tracks, trails and burrows made by organisms in the sediment) of the Cardium Formation and were given an overview of its reservoir characteristics in the Pembina field.

Figure 4. Cardium Formation below the Seebe Dam.

Figure 5. Conglomerate exposures at Seebe Dam.

This field stop was followed by one directly west of the Seebe dam, where Lafarge Concrete Inc. is presently mining thick exposures of shale (Figure 6). These shales are part of the Wapiabi Formation, which overlies the

Cardium Formation and acts as a seal to prevent the escape of hydrocarbons and CO_2 trapped in the Cardium Formation reservoirs in the Alberta subsurface. The shale quarry is associated with the Lafarge Seebe cement plant, which is an example of a high-purity CO_2 emitter.

Figure 6. Lafarge shale quarry near Seebe.

On the last day, participants hiked to exposures of the Devonian reef carbonates of the Cairn Formation near the picturesque Grassi Lakes above Canmore (Figure 7).

Figure 7. Devonian outcrops above Grassi Lakes, near Canmore.

The rocks of the Cairn Formation are equivalent to the Leduc strata in the Alberta subsurface - the same rocks into which acid gas is injected at two sites in the Provost area, and in which Imperial Oil struck it rich at Leduc in 1947, kicking off the Alberta oil rush. Field trip participants were given an overview of the paleogeography during the Devonian and introduced to the characteristics of the rocks that make them such prolific hydrocarbon reservoirs and suitable targets for the injection and storage of acid gases. ❖

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ESR 1972-11 Hydrogeology of the Tawatinaw Area, Alberta.

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Conferences Involving Alberta Geological Survey

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January 29 - February 1, 2007
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Prospectors and Developers Association of Canada
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Metro Toronto Convention Centre
Toronto, Ontario

Calgary Mining Forum
March 20-23, 2007
Ramada Hotel
Calgary, Alberta

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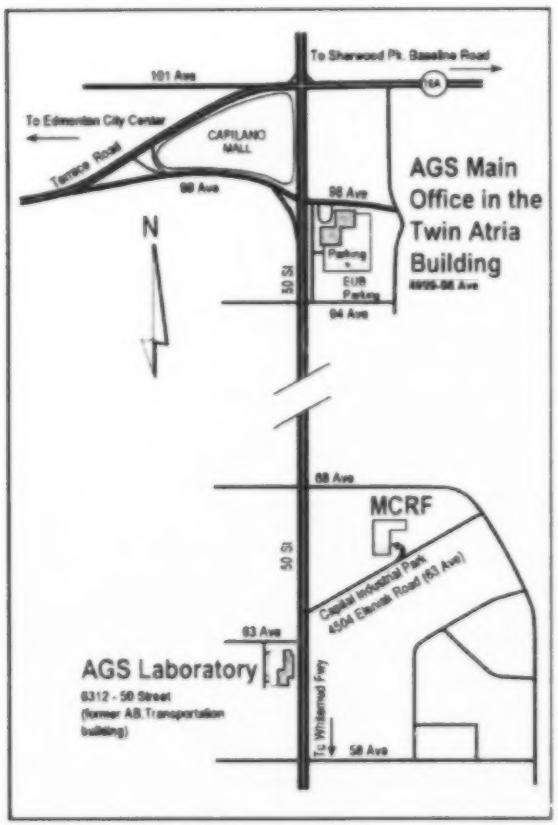
Earth Sciences Reports

ESR 2006-07 Turtle Mountain Field Laboratory Montioring and Research Summary Report, 2005. 44.3 MB PDF. $20.00

Maps

MAP 314 Surficial Geology of the Sawn Lake Area (NTS 84B/13). Scale 1:50 000. 9.81 MB PDF. $20.00



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